

CLAIMS:

1. A data transmission method for compensating for non-linearities of a transmission chain, the method comprising:

first forming at least one time-domain compensation parameter vector;

second forming at least one frequency-domain compensation parameter vector;

determining at least one set of signal properties modeling the non-linearities in a transmission chain;

third forming, based on the at least one set of signal properties, at least one state expansion vector comprising quantities characterizing a signal;

modifying the signal characterizing quantities of at least one state expansion vector with the at least one time-domain compensation parameter vector and with the at least one frequency-domain compensation parameter vector to form a pre-distorted signal;

fourth forming a feedback signal from an output signal of a transmission chain;

first adapting the at least one time-domain compensation parameter vector based on a residual error between a transmit signal and the feedback signal; and

second adapting the at least one frequency-domain compensation parameter vector based on the residual error between the transmit signal and the feedback signal.

2. A data transmission method for compensating for non-linearities of a transmission chain, the method comprising:

first forming at least one time-domain compensation parameter vector;

second forming at least one frequency-domain compensation parameter vector;

determining at least one set of signal properties modeling non-linearities in a transmission chain;

third forming, based on the at least one set of signal properties, at least one state expansion vector comprising quantities characterizing a signal;

modifying the signal characterizing quantities of at least one state expansion vector with the at least one time-domain compensation parameter vector and with the at least one frequency-domain compensation parameter vector to form a pre-distorted signal;

fourth forming a feedback signal from an output signal of a transmission chain;

filtering the feedback signal to minimize a non-linear frequency response of a feedback chain;

first adapting the at least one time-domain compensation parameter vector based on a residual error between a transmit signal and the feedback signal,

second adapting the at least one frequency-domain compensation parameter vector based on a residual error between a transmit signal and the feedback signal; and

third adapting at least one compensation parameter vector of a feedback filter based on a residual error between the transmit signal and the feedback signal.

3. The method of claim 1, wherein the step of said first forming further comprises selecting the at least one time-domain further comprises selecting the compensation parameter vector based on at least one of a transmission power, a frequency, a bandwidth and another transmission chain property.

4. The method of claim 1, wherein the step of second forming further comprises at step of selecting the at least one frequency-domain compensation parameter vector based on at least one of a transmission power, frequency, bandwidth and another transmission chain property.

5. The method of claim 1, further comprising a step of selecting a state expander functions based on at least one of a transmission power, a frequency, a bandwidth and another transmission chain property.

6. The method of claim 1, wherein the step of said third forming the at least one state expansion vector further comprises a step of including a function selected from at least one of a function for memoryless pre-emphasizing, a function for dynamic pre-emphasizing, a function for weighted integral dynamic pre-emphasizing and a function for cross-term dynamic pre-emphasizing.

7. The method of claim 2, wherein the step of said third adapting further comprises a step of configuring compensation parameters of the at least one compensation parameter vector based on the residual error between the transmit signal and the feedback signal.

8. The method of claim 1, wherein the step of said first forming further comprises a step of searching at least one time-domain compensation parameter vector and the at least one frequency domain compensation parameter vector for predetermined signal properties.

9. The method of claim 1, further comprising a step of performing a time-domain pre-distortion in a polar coordinate system.

10. The method of claim 2, further comprising a step of performing time-domain pre-distortion and the step of adapting further comprises a step of performing the at least one time-domain compensation parameter vector in a polar coordinate system.

11. A transmitter for compensating for non-linearities of a transmission chain, the transmitter comprising:

first forming means for forming at least one time-domain compensation parameter vector;

second forming means for forming at least one frequency-domain compensation parameter vector;

determining means for determining at least one set of signal properties modeling non-linearities in a transmission chain;

third forming means for forming, based on the at least one set of signal properties, at least one state expansion vector comprising quantities characterizing a signal;

modifying means for modifying the signal characterizing quantities of at least one state expansion vector with the at least one time-domain

compensation parameter vector and with the at least one frequency-domain compensation parameter vector to form a pre-distorted signal;

fourth forming means for forming a feedback signal from an output signal of a transmission chain;

first adapting means for adapting the at least one time-domain compensation parameter vector based on a residual error between a transmit signal and the feedback signal; and

second adapting means for adapting the at least one frequency-domain compensation parameter vector based on the residual error between the transmit and the feedback signal.

12. A transmitter for compensating for non-linearities of a transmission chain, the transmitter comprising:

first forming means for forming at least one time-domain compensation parameter vector;

second forming means for forming at least one frequency-domain compensation parameter vector;

determining means for determining at least one set of signal properties modeling the non-linearities in a transmission chain;

third forming means for forming, based on the at least one set of signal properties, at least one state expansion vector comprising quantities characterizing a signal;

modifying means for modifying the signal characterizing quantities of at least one state expansion vector with the at least one time-domain compensation parameter vector and with the at least one frequency-domain compensation parameter vector to form a pre-distorted signal;

fourth forming means for forming a feedback signal from an output signal of a transmission chain;

filtering means for filtering the feedback signal to minimize a non-linear frequency response of a feedback chain;

first adapting means for adapting the at least one time-domain compensation parameter vector based on a residual error between a transmit signal and the feedback signal;

second adapting means for adapting the at least one frequency-domain compensation parameter vector based on the residual error between the transmit signal and the feedback signal; and

third adapting means for adapting at least one compensation parameter vector of a feedback filter based on the residual error between the transmit signal and the feedback signal

13. The transmitter of claim 11, further comprising selecting means for selecting the at least one time-domain compensation parameter vector based on at least one of a transmission power, a frequency, a bandwidth or another transmission chain property.

14. The transmitter of claim 11, further comprising selecting means for selecting at least one frequency-domain compensation parameter vector based on at least one of a transmission power, a frequency, a bandwidth or another transmission chain property.

15. The transmitter of claim 11, further comprising selecting means for selecting state expander functions based on a transmission power, a frequency, a bandwidth or another transmission chain property.

16. The transmitter of claim 11, further comprising searching means for searching the at least one time-domain compensation parameter vector and the at least one frequency-domain compensation parameter vector for predetermined signal properties.

17. The transmitter of claim 12, further comprising fourth adapting means for adapting compensation parameters of the at least one compensation parameter vector based on the residual error between the transmit signal and the feedback signal.

18. The transmitter of claim 11, further comprising distorting means for performing a time-domain pre-distortion in a polar coordinate system.

19. The transmitter of claim 12, further comprising distorting means for performing a time-domain pre-distortion and fourth adapting means for adapting the at least one time-domain compensation parameter vector in a polar coordinate system.

20. A transmitter for compensating for non-linearities of a transmission chain, the transmitter being configured to:

form at least one time-domain compensation parameter vector;

form at least one frequency-domain compensation parameter vector;

determine at least one set of signal properties modeling the non-linearities in a transmission chain;

form, based on the at least one set of signal properties, at least one state expansion vector comprising quantities characterizing a signal;

modify the signal characterizing quantities of at least one state expansion vector with the at least one time-domain compensation parameter vector and with the at least one frequency-domain compensation parameter vector to form a pre-distorted signal;

form a feedback signal from an output signal of a transmission chain;;

adapt the at least one time-domain compensation parameter vector based on a residual error between a transmit signal and the feedback signal;
and

adapt the at least one frequency-domain compensation parameter vector based on the residual error between the transmit signal and the feedback signal.

21. A transmitter for compensating for non-linearities of a transmission chain, the transmitter being configured to:

form at least one time-domain compensation parameter vector;

form at least one frequency-domain compensation parameter vector;

determine at least one set of signal properties modeling the non-linearities in a transmission chain;

form, based on at least one set of signal properties, at least one state expansion vector comprising quantities characterizing a signal;

modify the signal characterizing quantities of at least one state expansion vector with the at least one time-domain compensation parameter vector and with the at least one frequency-domain compensation parameter vector to form a pre-distorted signal;

form a feedback signal from an output signal of a transmission chain;

filter the feedback signal to minimize a non-linear frequency response of a feedback chain;

adapt the at least one time-domain compensation parameter vector based on a residual error between a transmit and the feedback signal;

adapt the at least one frequency-domain compensation parameter vector based on the residual error between the transmit signal and the feedback signal; and

adapt at least one coefficient of a feedback filter based on the residual error between the transmit signal and the feedback signal.

22. A base station, wherein non-linearities of a transmission chain are compensated for, the base station comprising:

first forming means for forming at least one time-domain compensation parameter vector;

second forming means for forming at least one frequency-domain compensation parameter vector;

determining means for determining at least one set of signal properties modeling nonlinearities in a transmission chain;

third forming means for forming, based on the at least one set of signal properties, at least one state expansion vector comprising quantities characterizing a signal;

modifying means for modifying the signal characterizing quantities with the at least one time-domain compensation parameter vector and with the at least one frequency-domain compensation parameter vector to form a pre-distorted signal;

fourth forming means for forming a feedback signal from a transmission chain output signal;

first adapting means for adapting the at least one time-domain compensation parameter vector based on a residual error between a transmit signal and the feedback signal; and

second adapting means for adapting the at least one frequency-domain compensation parameter vector based on the residual error between the transmit signal and the feedback signal.

23. A base station, wherein nonlinearities of a transmission chain are compensated for, the base station comprising:

first forming means for forming at least one time-domain compensation parameter vector;

second forming means for forming at least one frequency-domain compensation parameter vector;

determining means for determining at least one set of signal properties modeling the nonlinearities in a transmission chain;

third forming means for forming, based on the at least one set of signal properties, at least one state expansion vector comprising quantities characterizing a signal;

modifying means for modifying the signal characterizing quantities with the at least one time-domain compensation parameter vector and with the at least one frequency-domain compensation parameter vector to form a pre-distorted signal;

fourth forming means for forming a feedback signal from an output signal of a transmission chain;

filtering means for filtering the feedback signal to minimize a non-linear frequency response of a feedback chain;

first adapting means for adapting the at least one time-domain compensation parameter vector based on a residual error between a transmit signal and the feedback signal;

second adapting means for adapting the at least one frequency-domain compensation parameter vector based on the residual error between the transmit signal and a feedback signal; and

third adapting means for adapting at least one compensation parameter vector of a feedback filter based on the residual error between the transmit signal and the feedback signal.